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Mateo Ferrús et al.

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(54) **TELECOMMUNICATIONS CASSETTE**

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 135 days.

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(21) Appl. No.: **13/912,825**

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(22) Filed: **Jun. 7, 2013**

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Related U.S. Application Data

(60) Provisional application No. 61/663,950, filed on Jun.
25, 2012.

(57) **ABSTRACT**

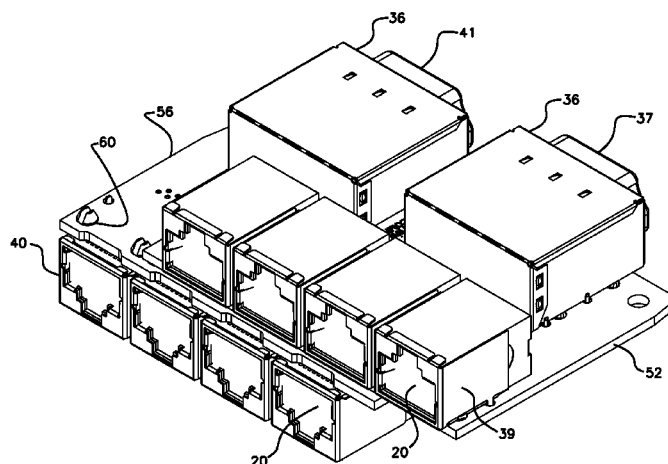
(51) **Int. Cl.**
H01R 13/518 (2006.01)
H01R 31/06 (2006.01)
H01R 13/66 (2006.01)
H04Q 1/02 (2006.01)

A telecommunications cassette (14, 114) that includes a
body (30) with a front (32) and an opposite rear (34), two
rows (38) of RJ45 jacks (20) disposed on the front (32), and
two MRJ21 connectors (36) disposed on the rear (34). The
two rows (38) of RJ45 jacks (20) are oriented opposite to
one another, and the two rows of RJ45 jacks are offset from
one another. The MRJ21 connectors (36) are oriented in the
same direction, and the MR21 connectors (36) are vertically
offset from one another. Two circuit boards (52, 56) are
provided within the body (30), wherein one row (38, 39, 40)
of RJ45 jacks (20) is connected to a respective one of the
MRJ21 connectors (36), and wherein one of the circuit
boards (50, 52, 56) includes a notch (66) for receiving one
of the MRJ21 connectors (36, 37, 41).

(52) **U.S. Cl.**
CPC **H01R 31/06** (2013.01); **H01R 13/518**
(2013.01); **H01R 13/6658** (2013.01); **H04Q**
1/13 (2013.01)

(58) **Field of Classification Search**
CPC H01R 13/518; H01R 13/6658; H01R 31/06;
H01R 12/51; H01R 23/68; H01R 23/70;
H01R 13/6469; H01R 13/6466; H04Q 1/13
USPC 439/540.1, 76.1, 638
See application file for complete search history.

9 Claims, 24 Drawing Sheets



US 9,484,694 B2

Page 2

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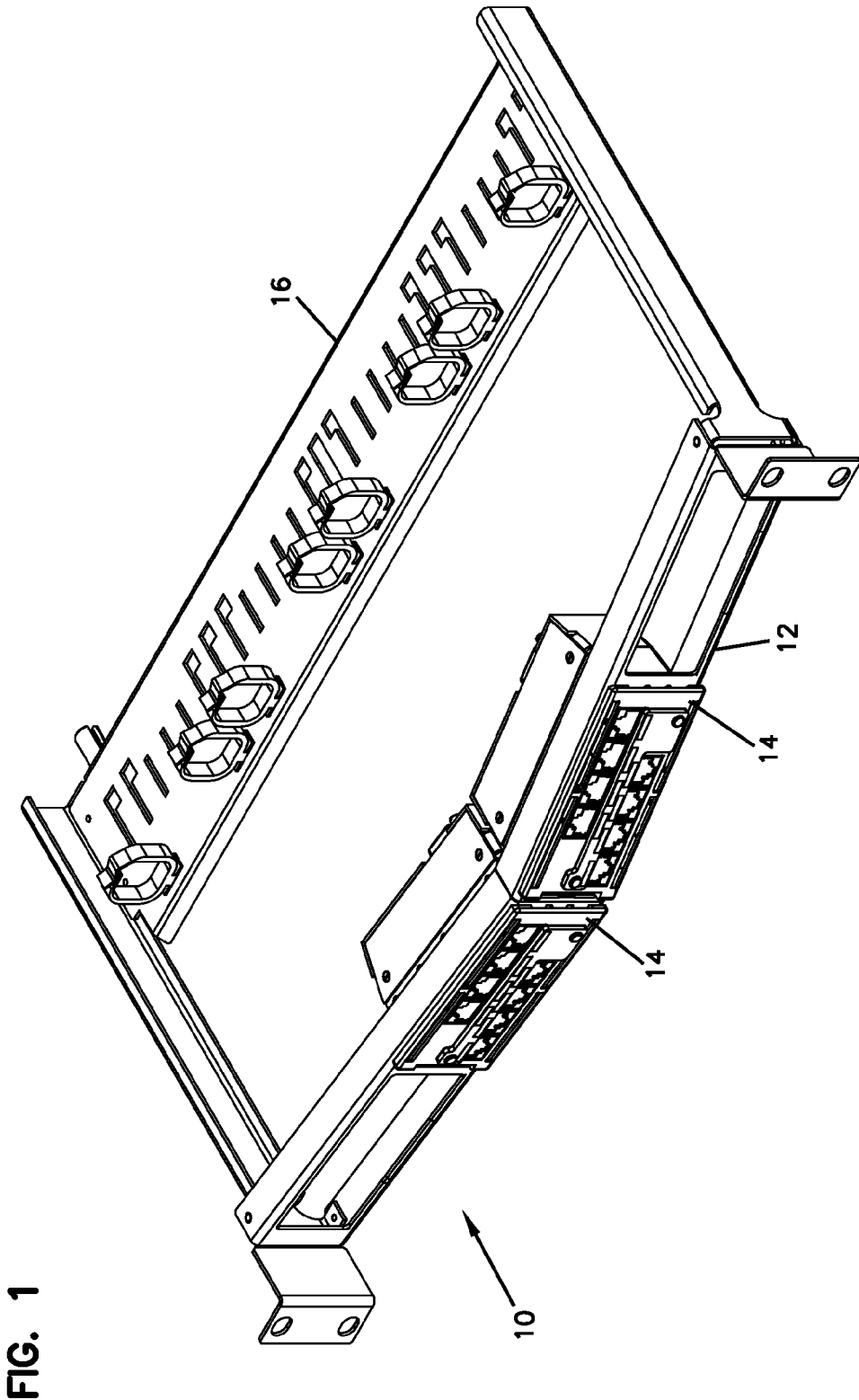
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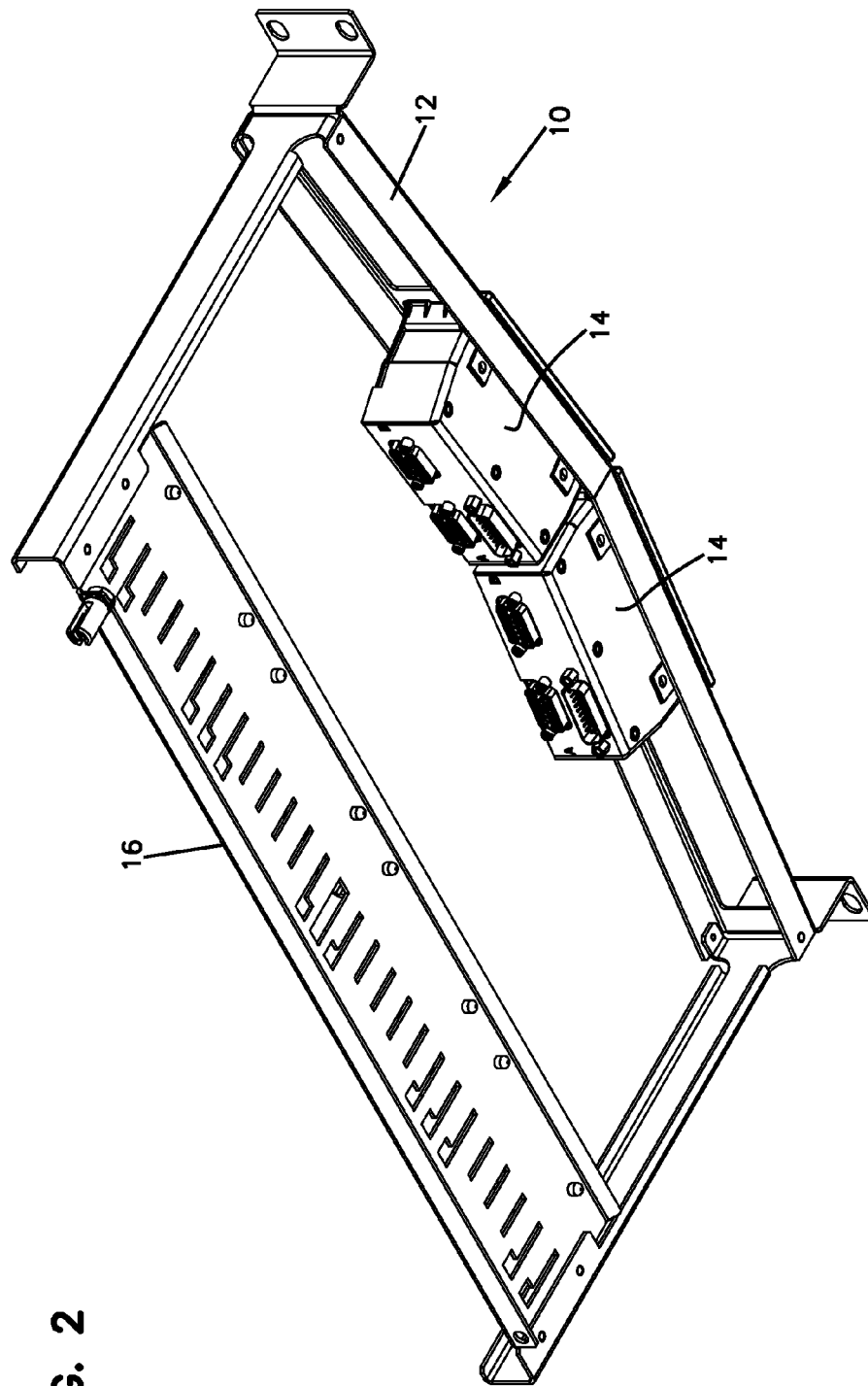


FIG. 2

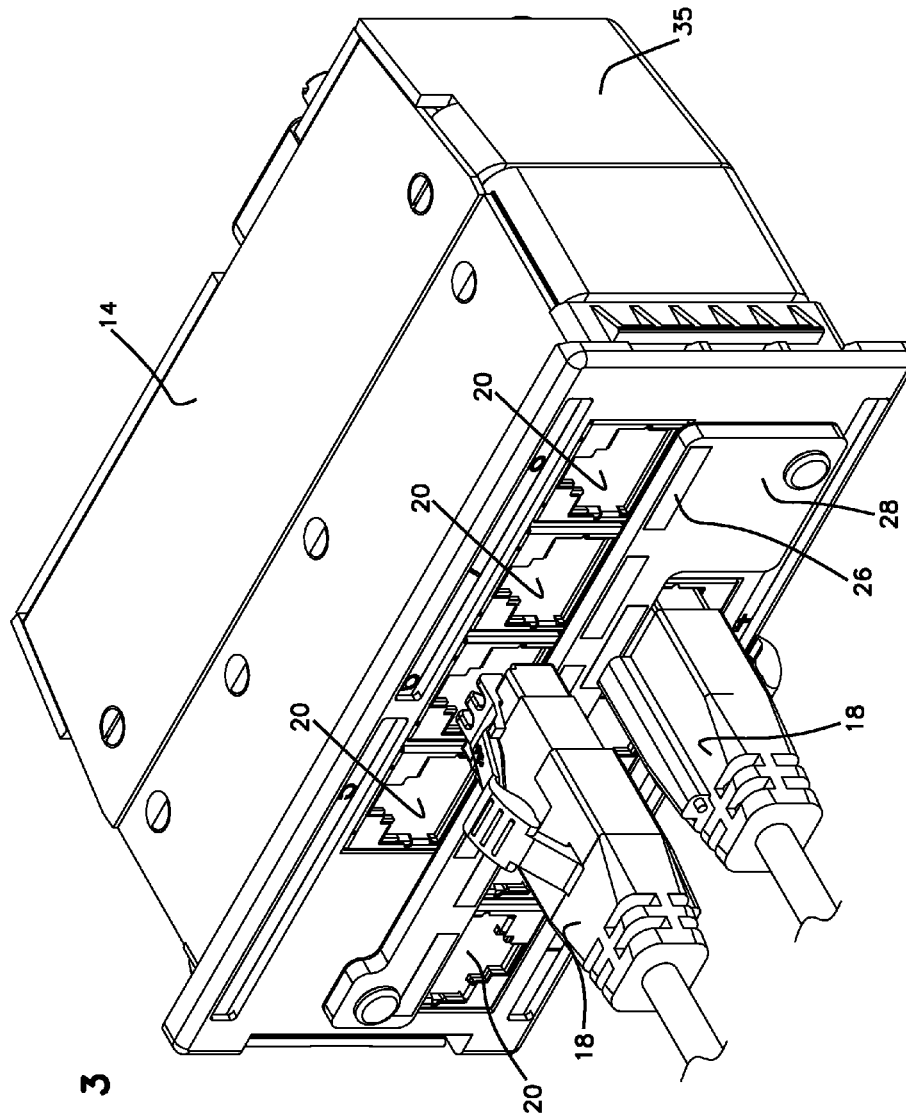


FIG. 3

FIG. 4

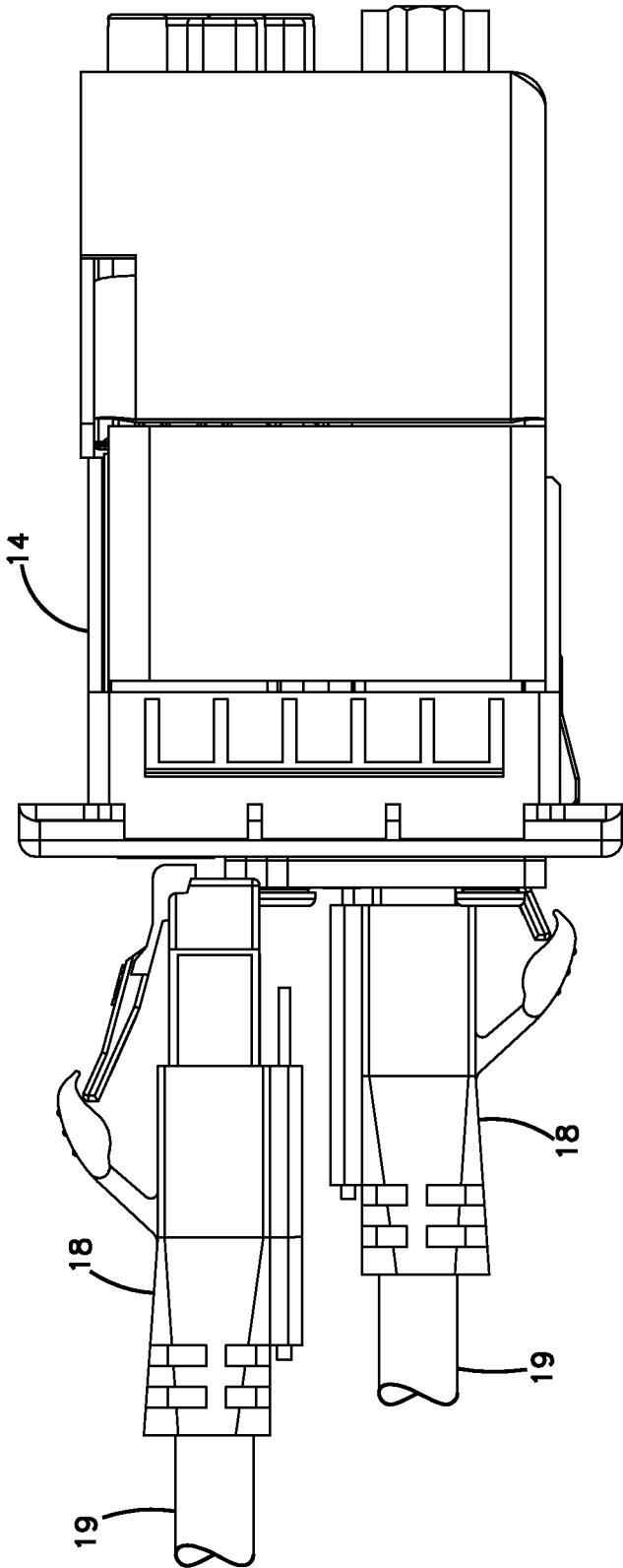


FIG. 5

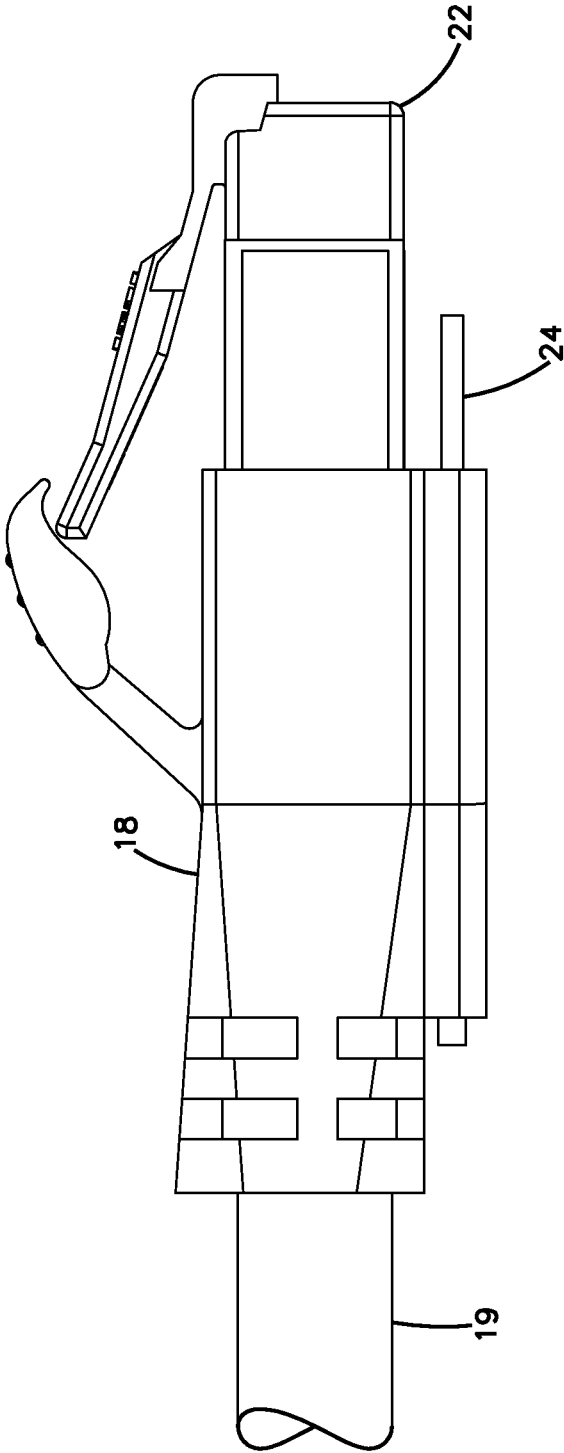


FIG. 6

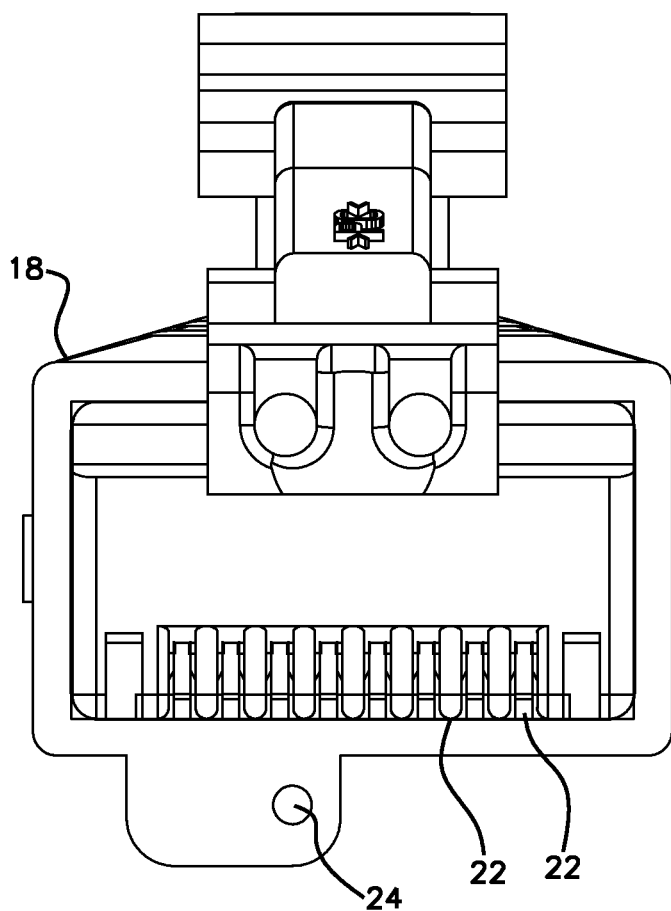
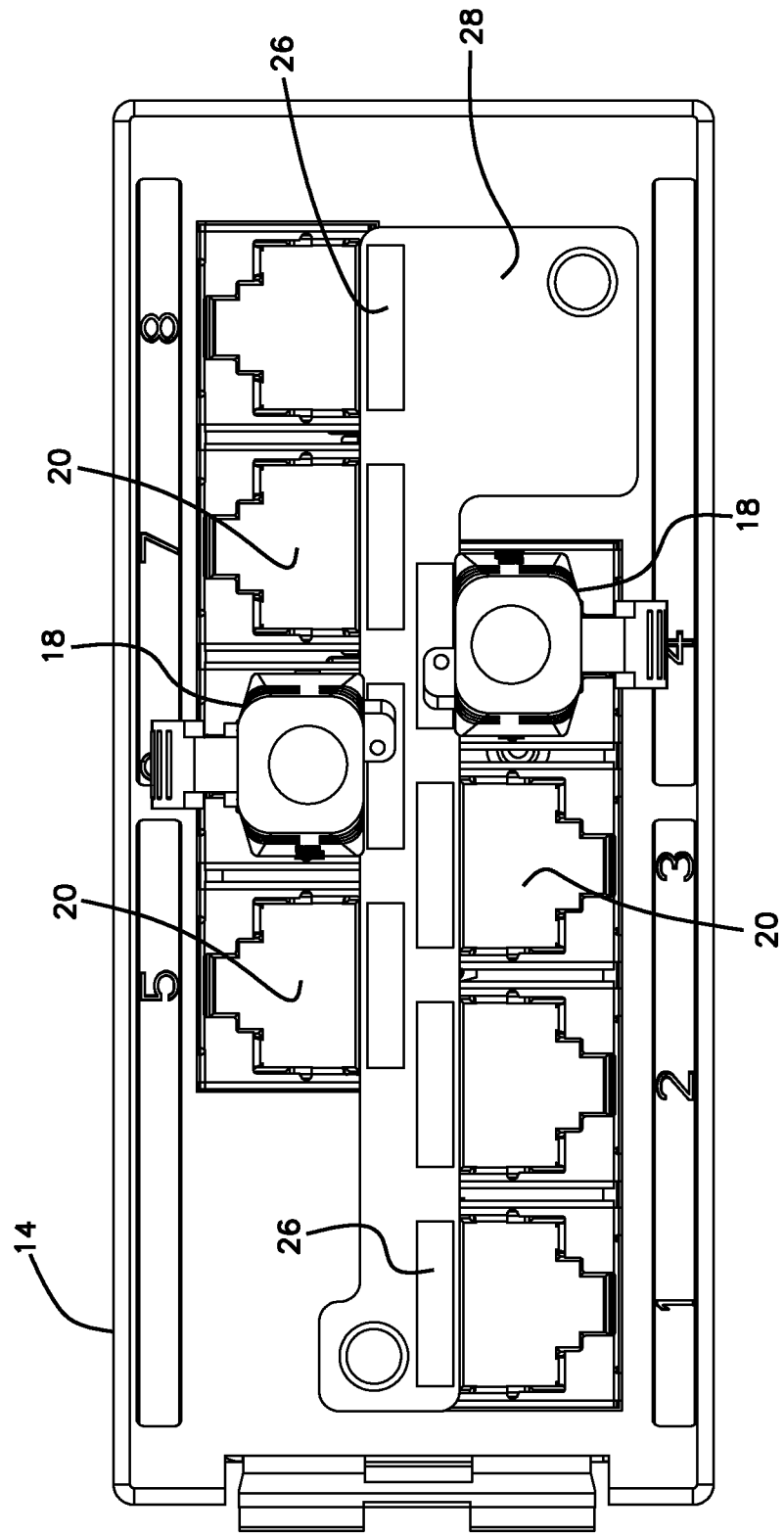


FIG. 7



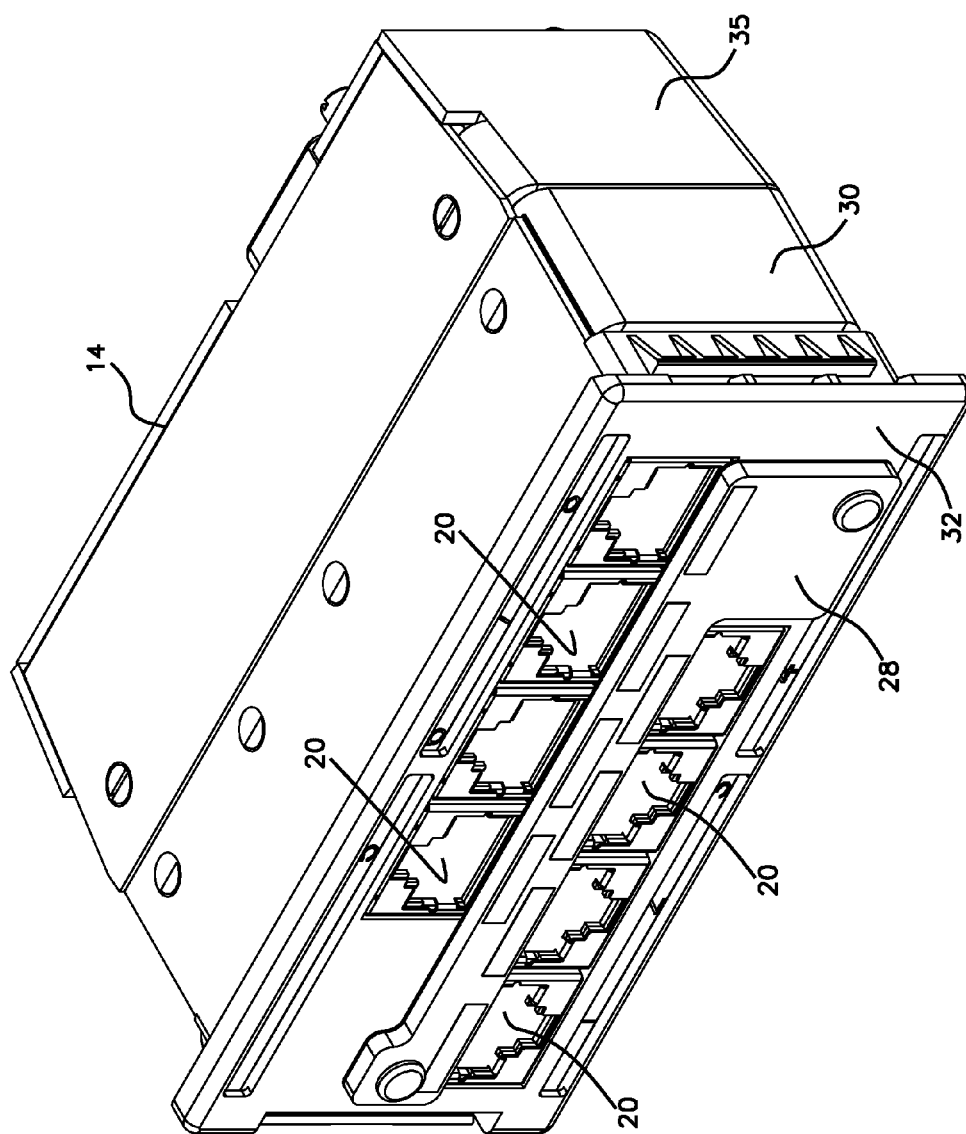
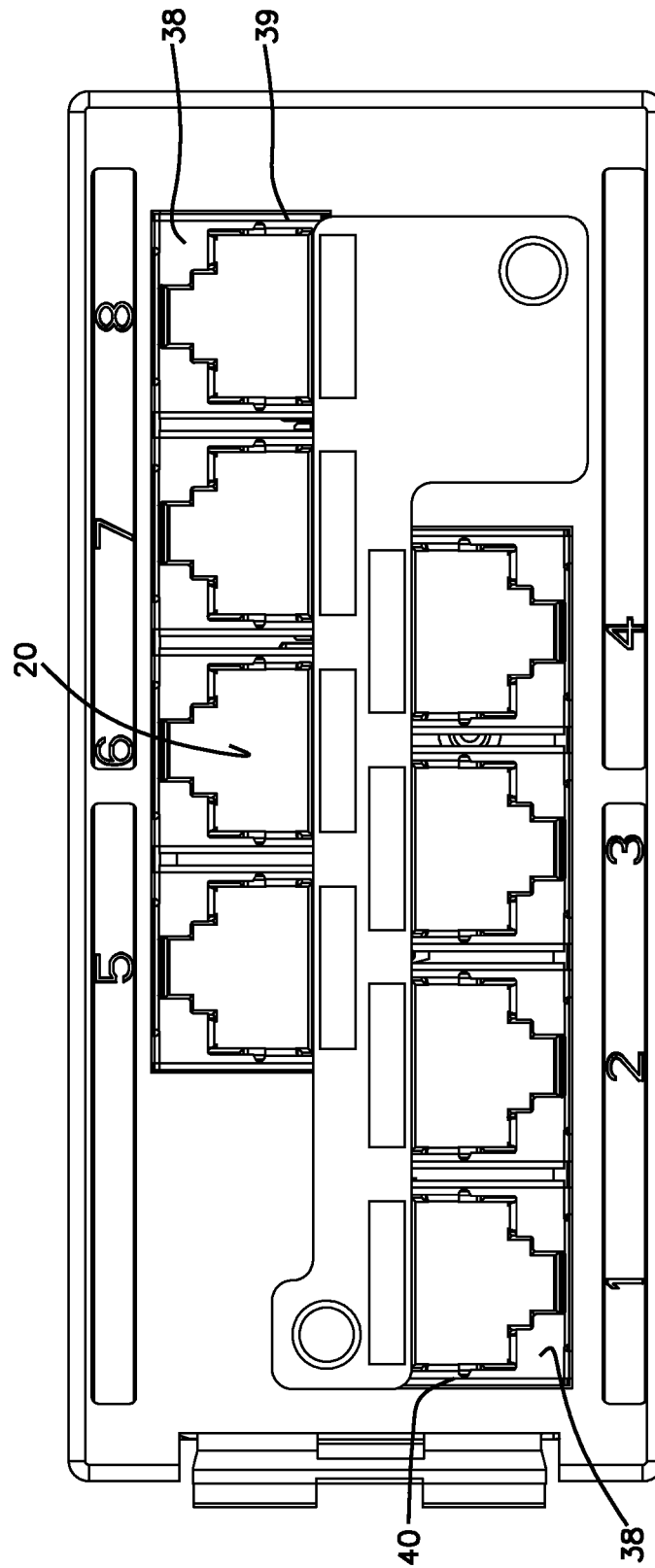


FIG. 8

FIG. 9



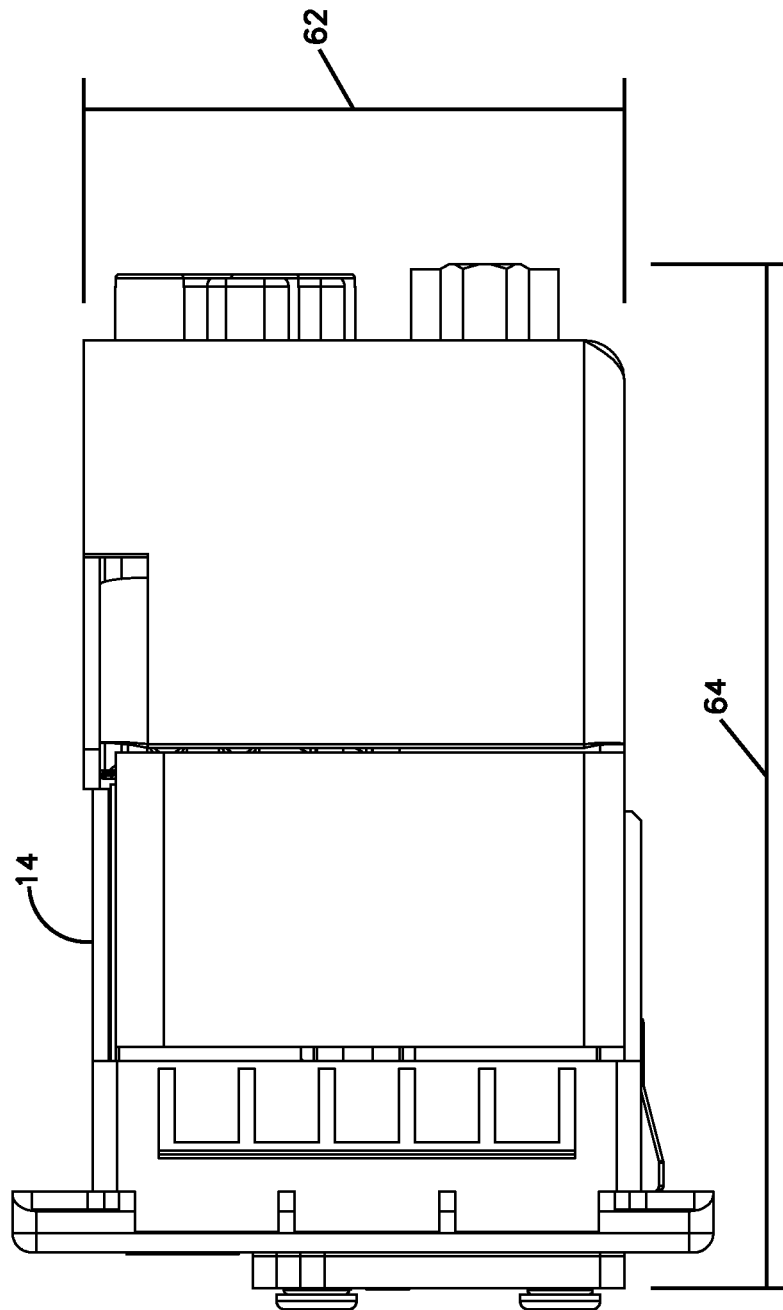
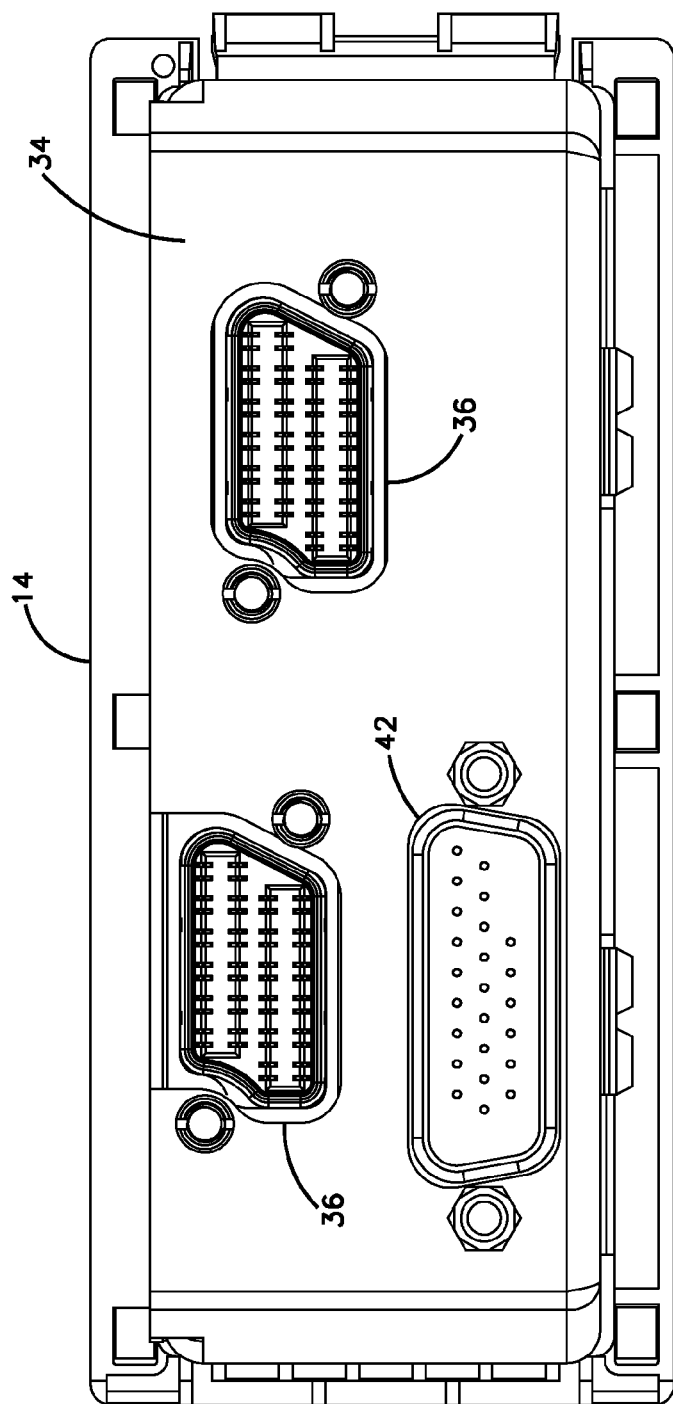


FIG. 10

FIG. 11



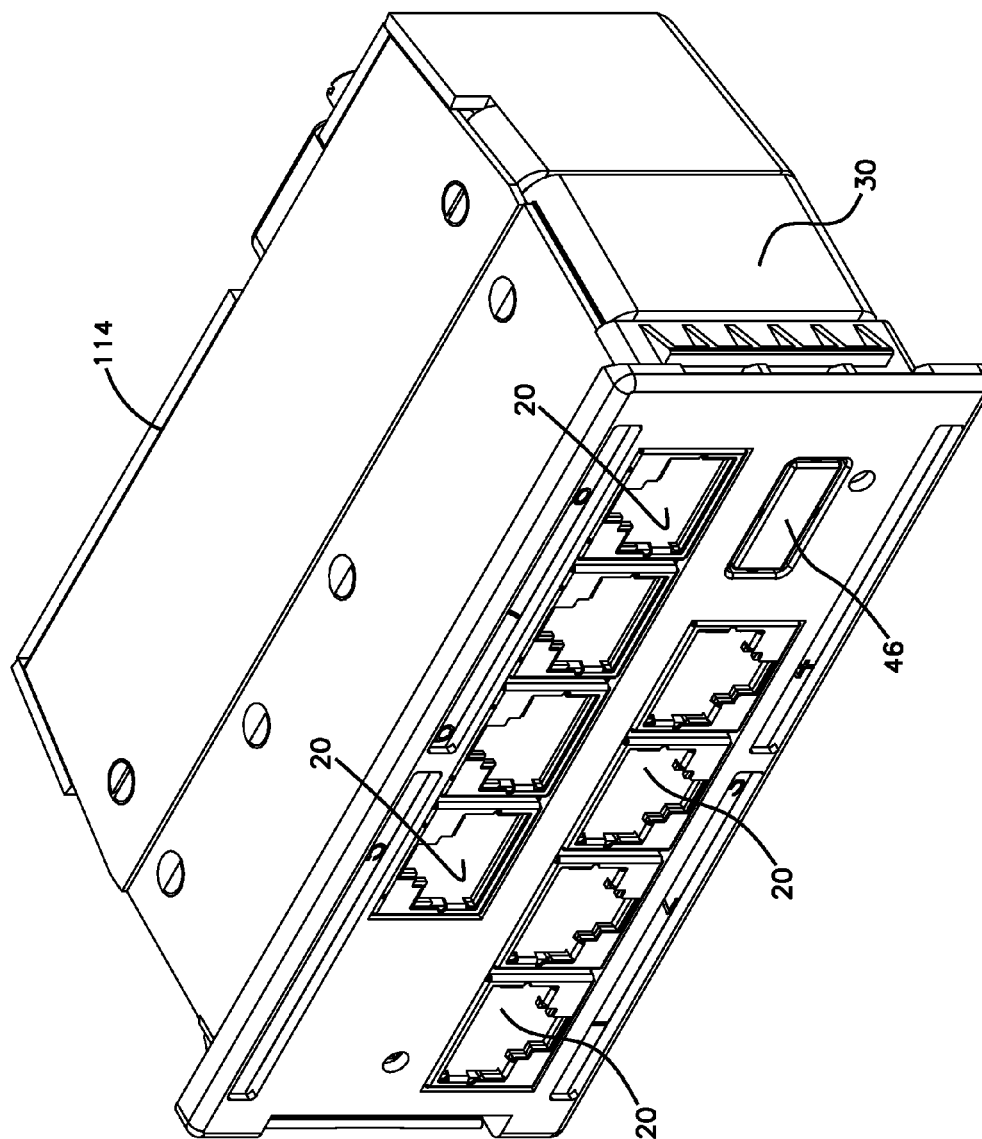


FIG. 12

FIG. 13

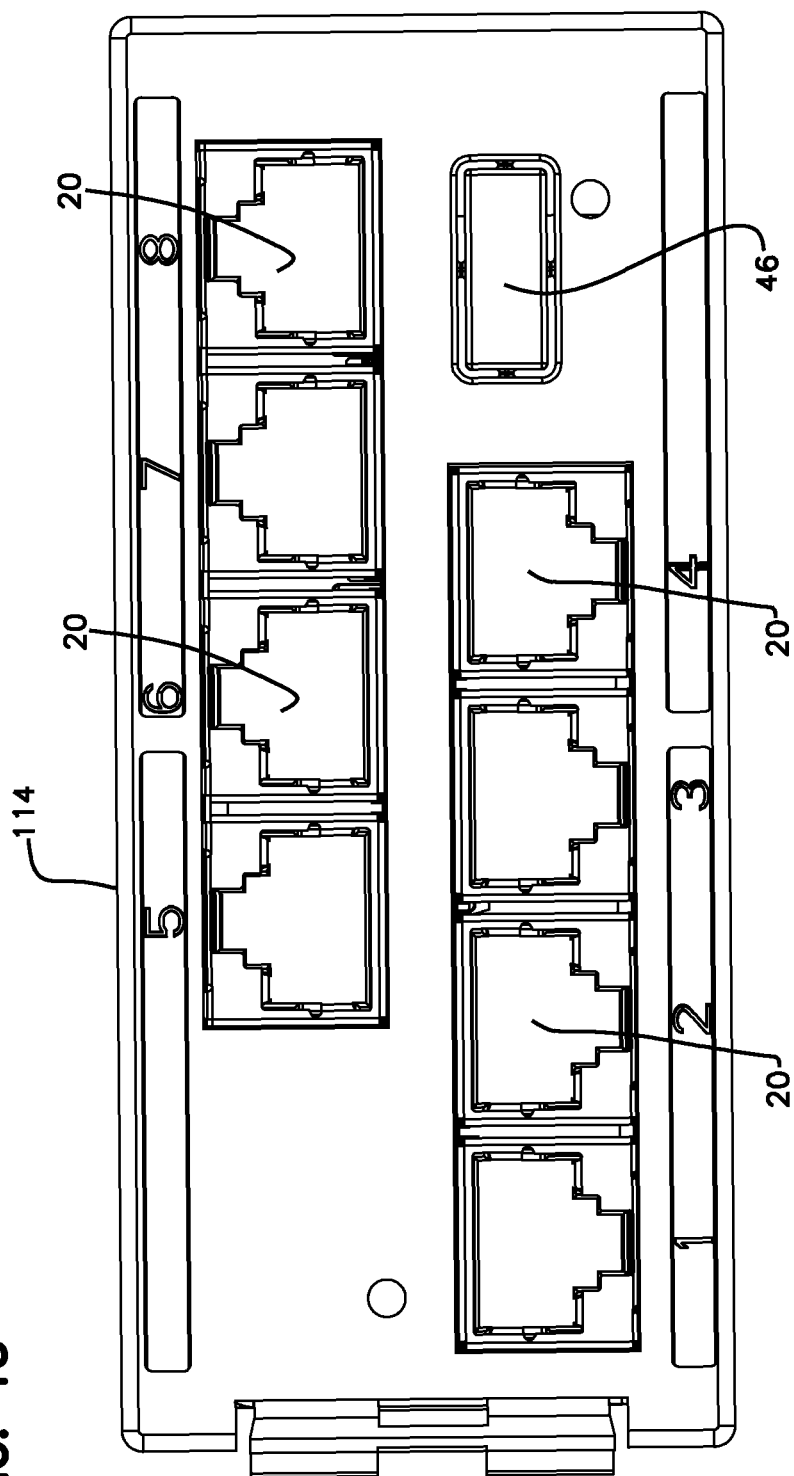
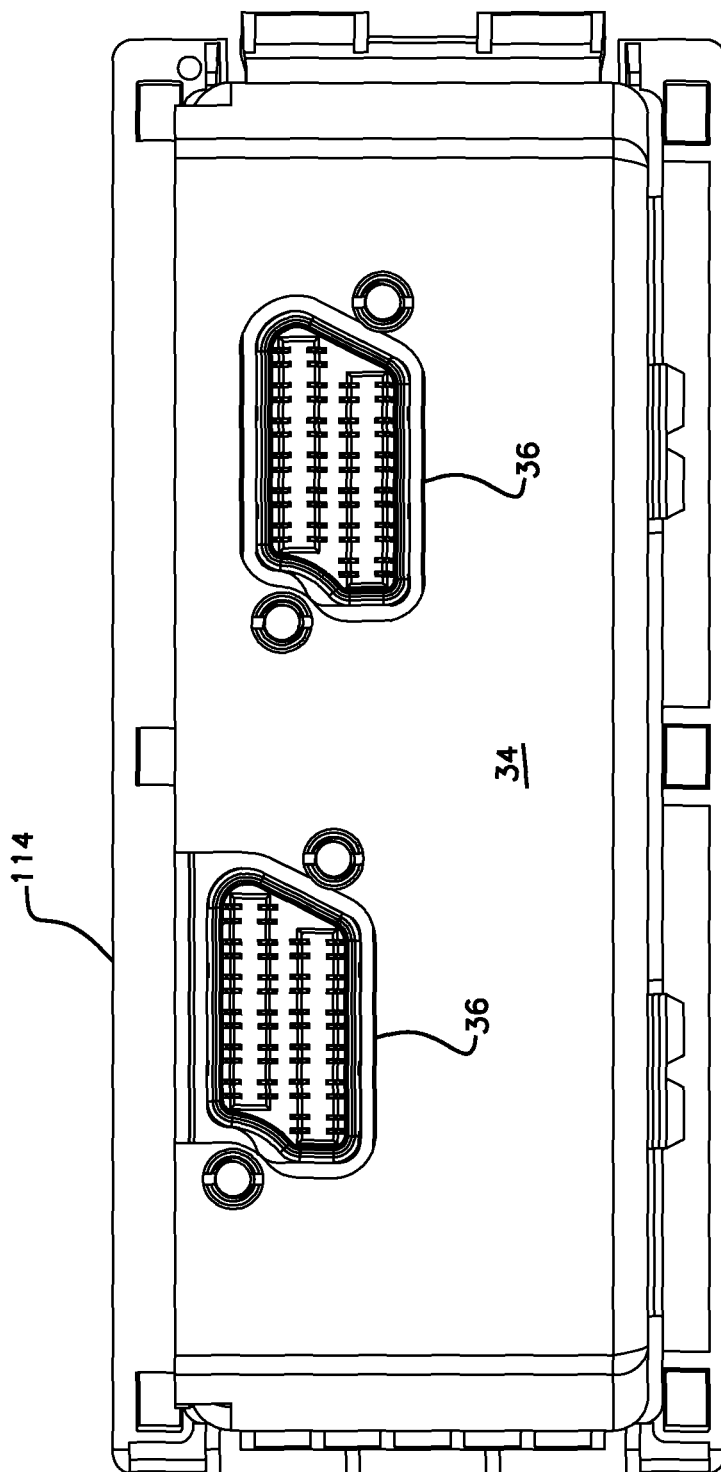


FIG. 14



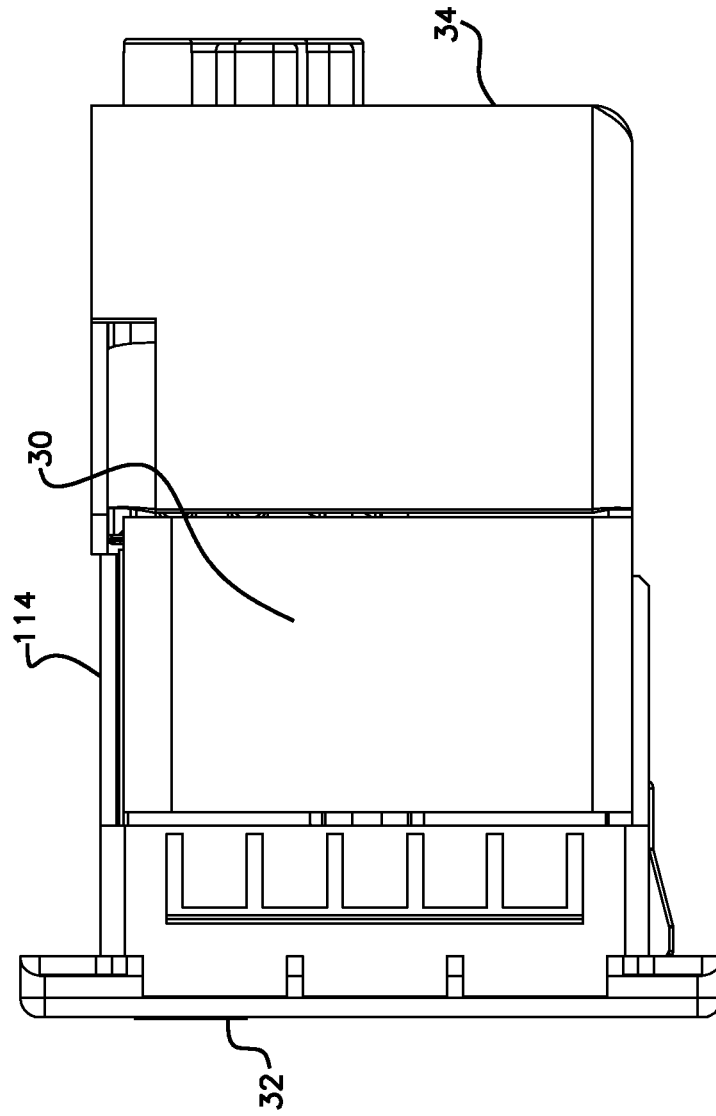


FIG. 15

FIG. 16

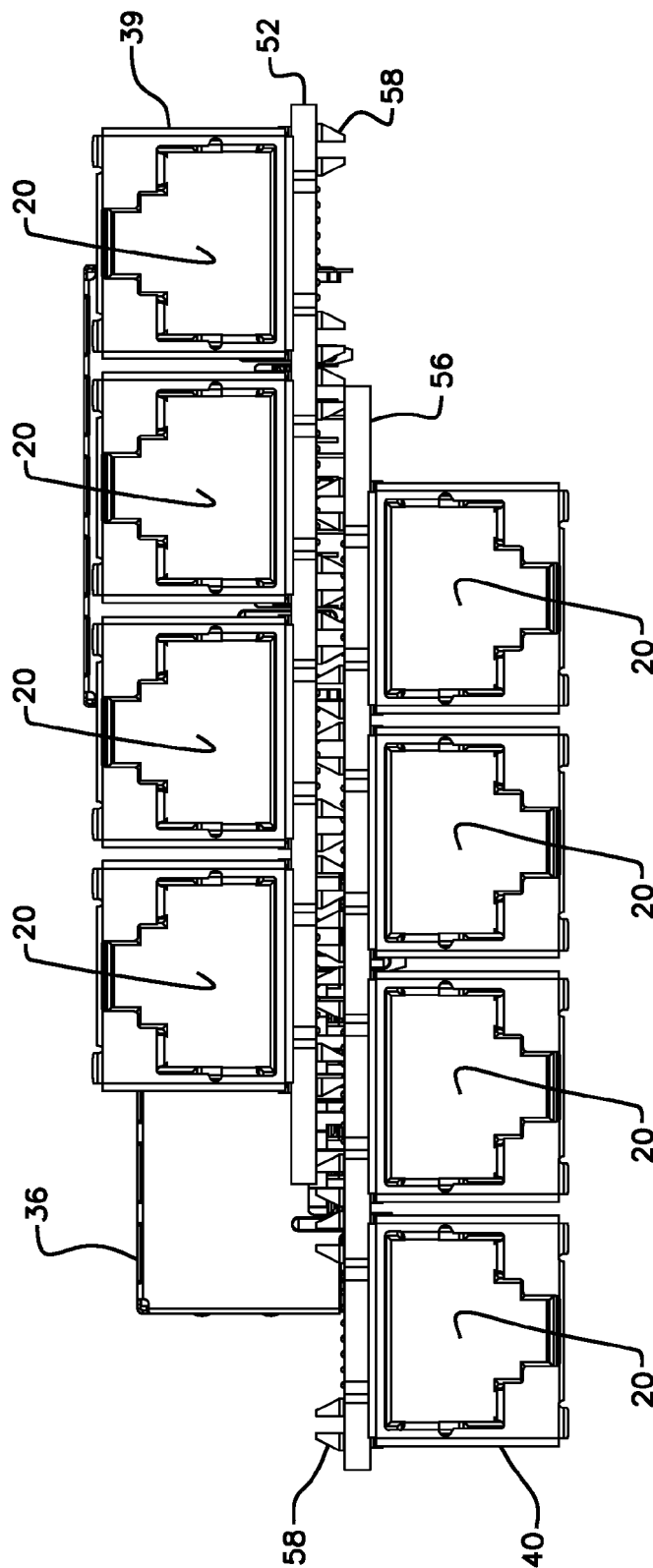


FIG. 17

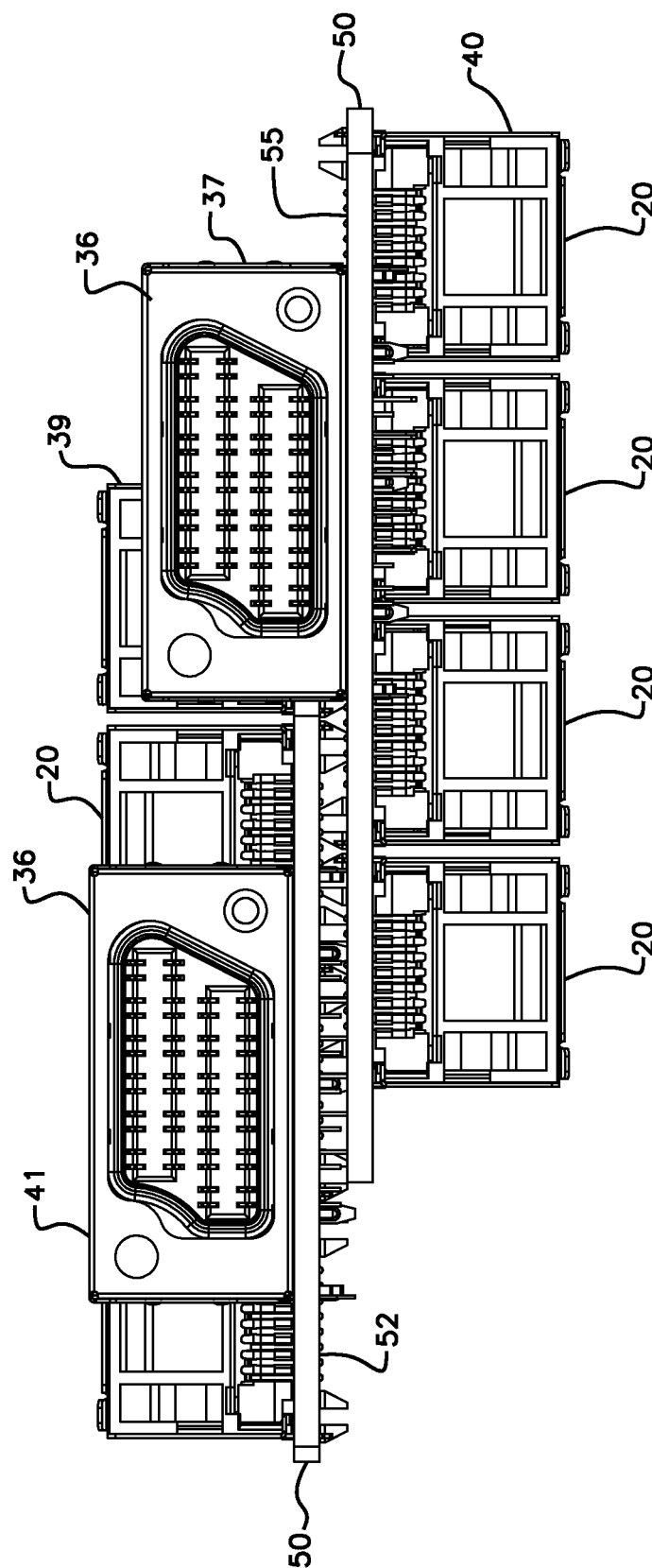
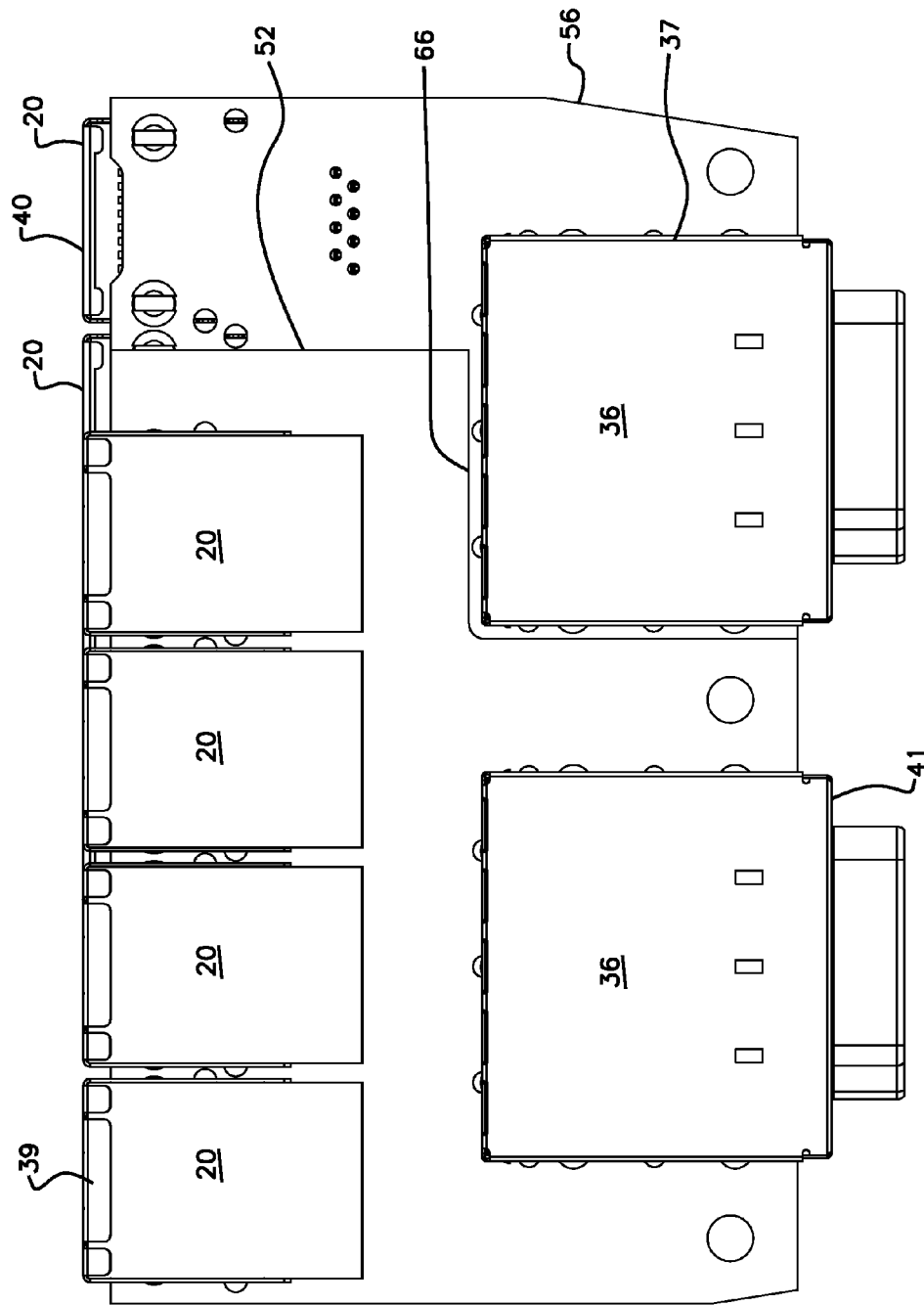


FIG. 18



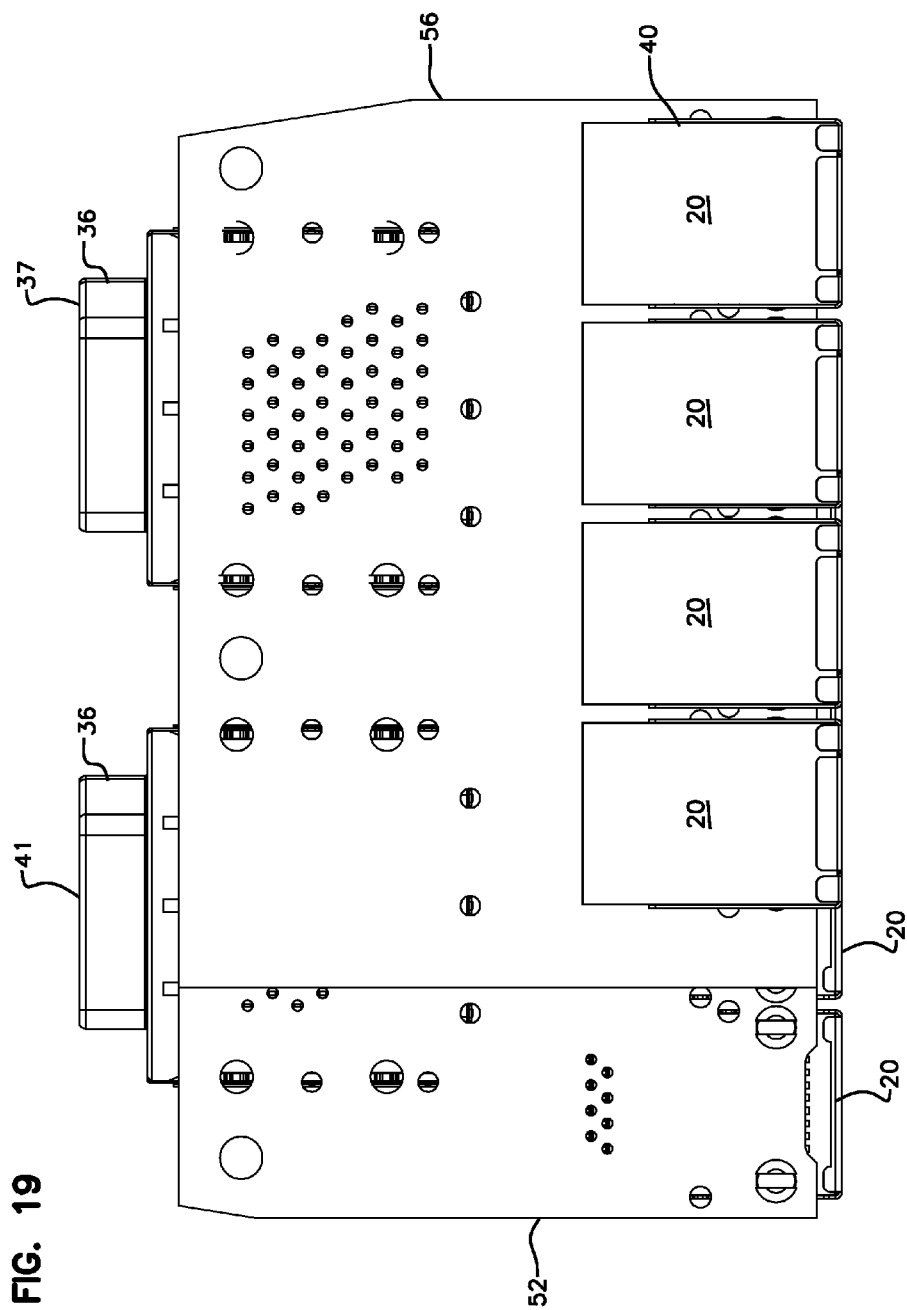
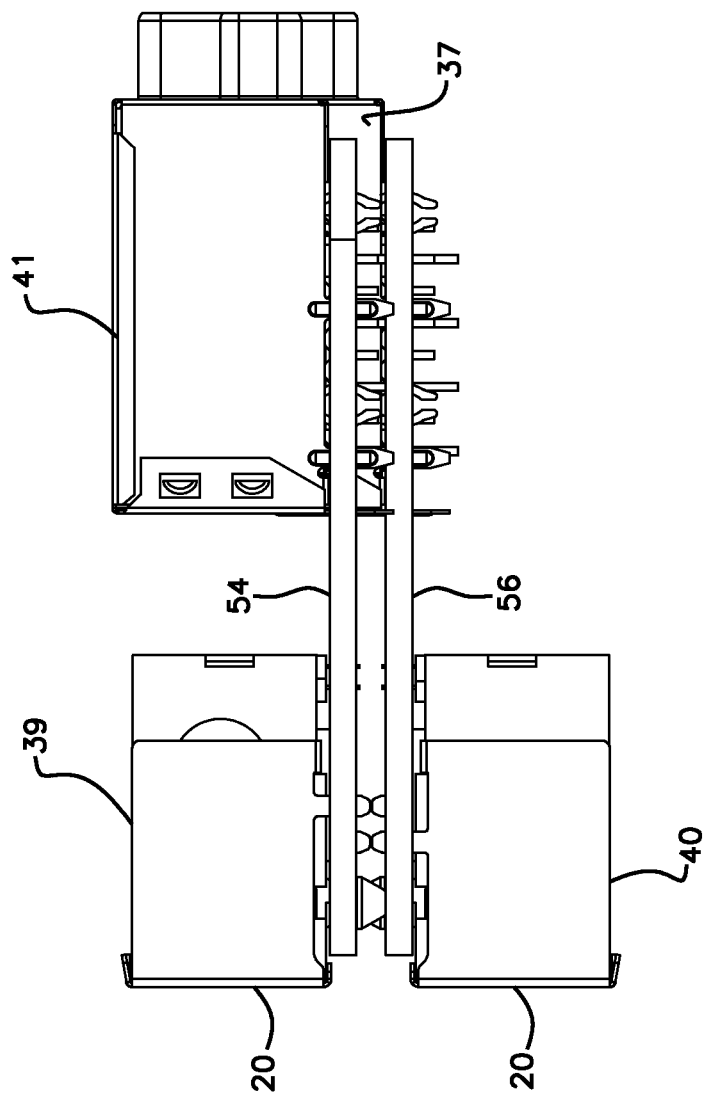


FIG. 20



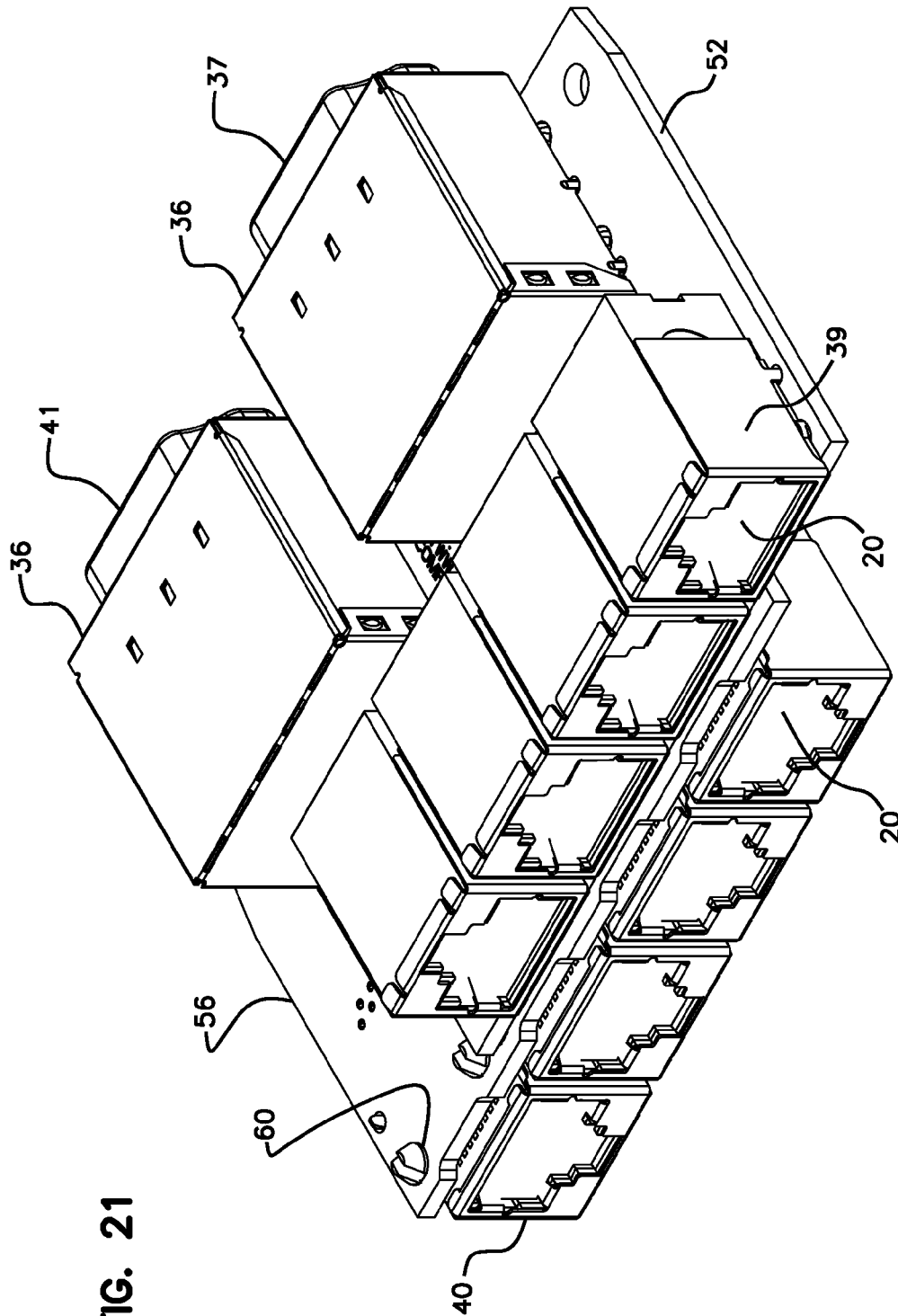


FIG. 21

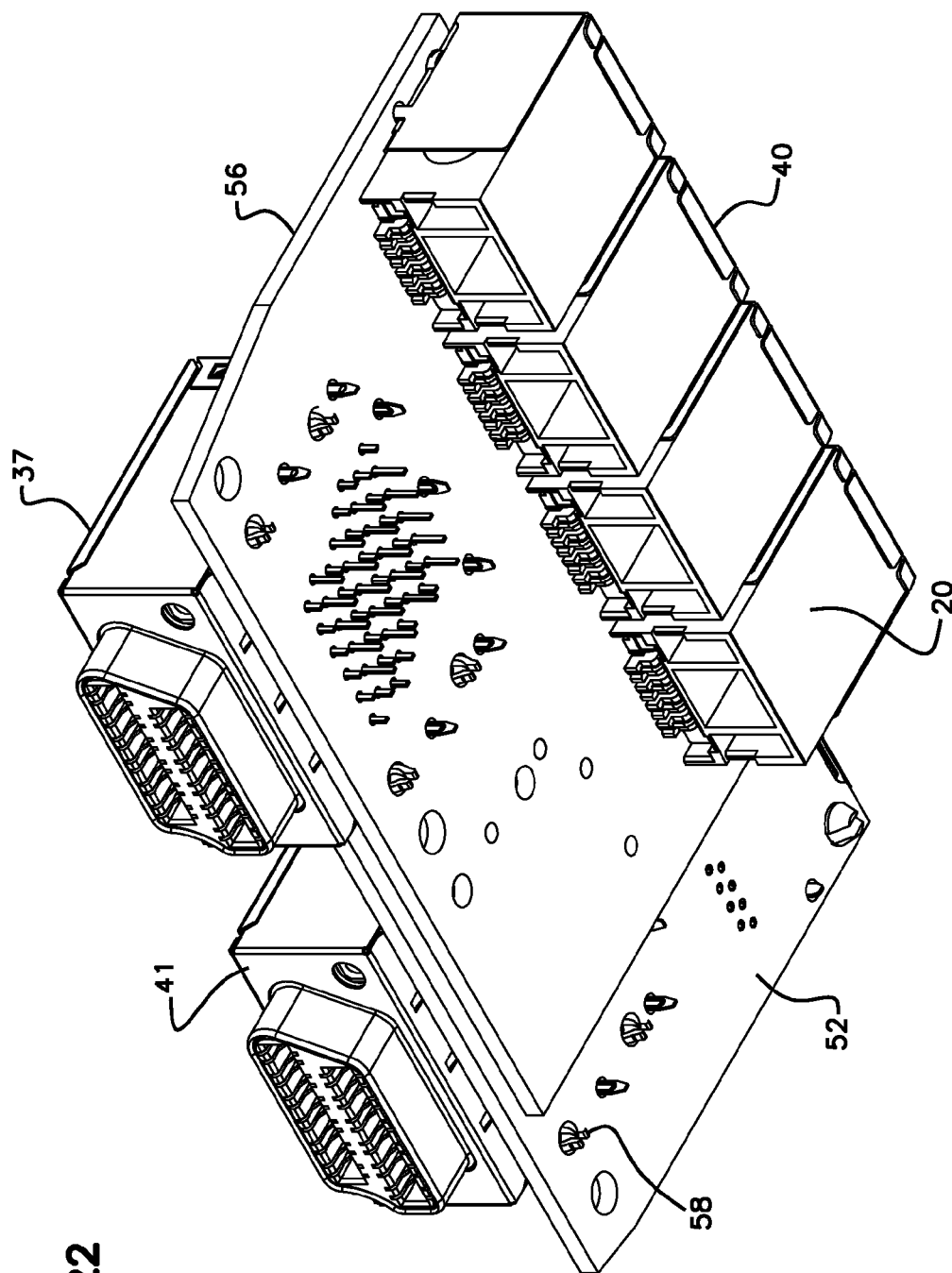
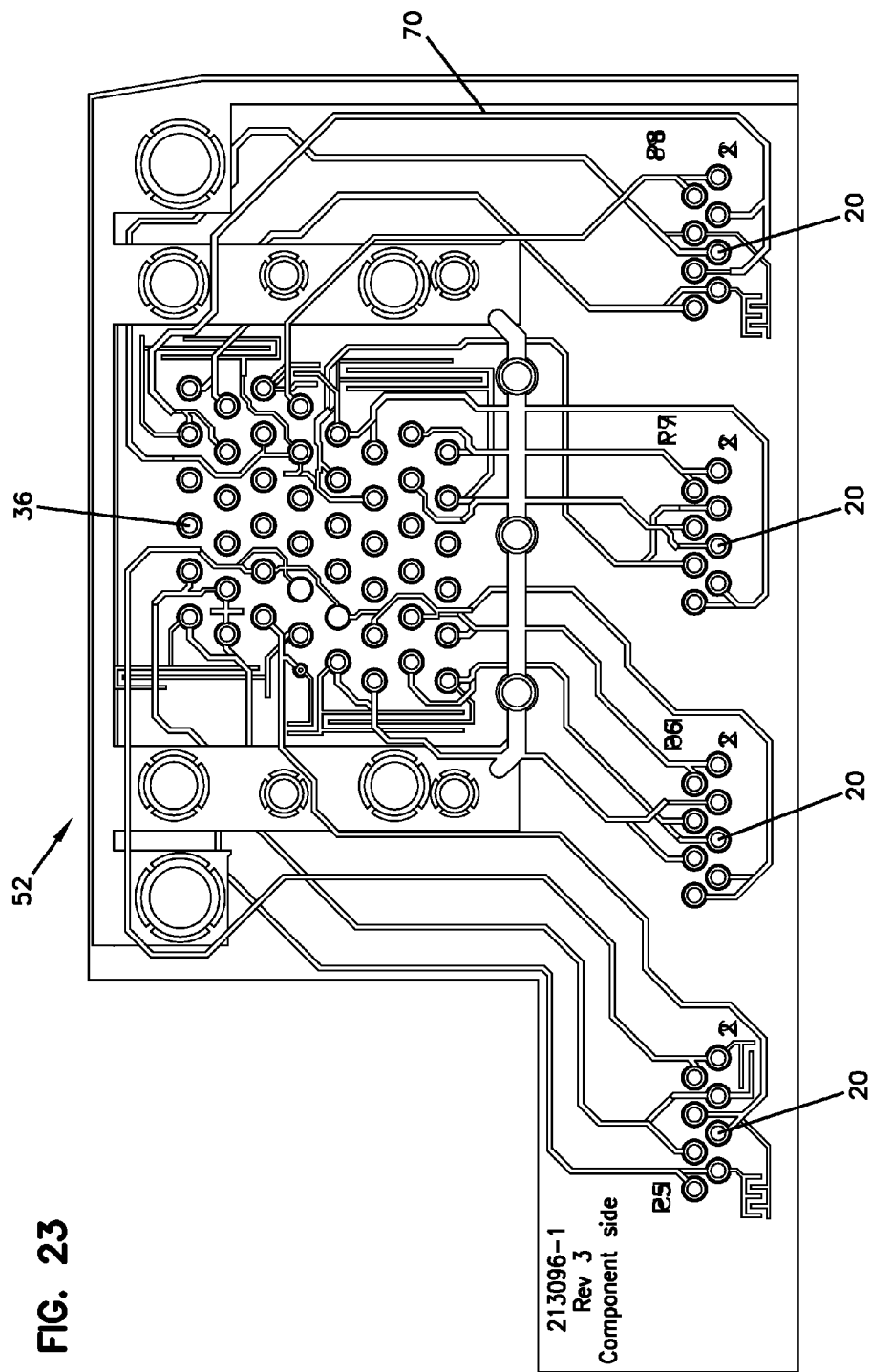
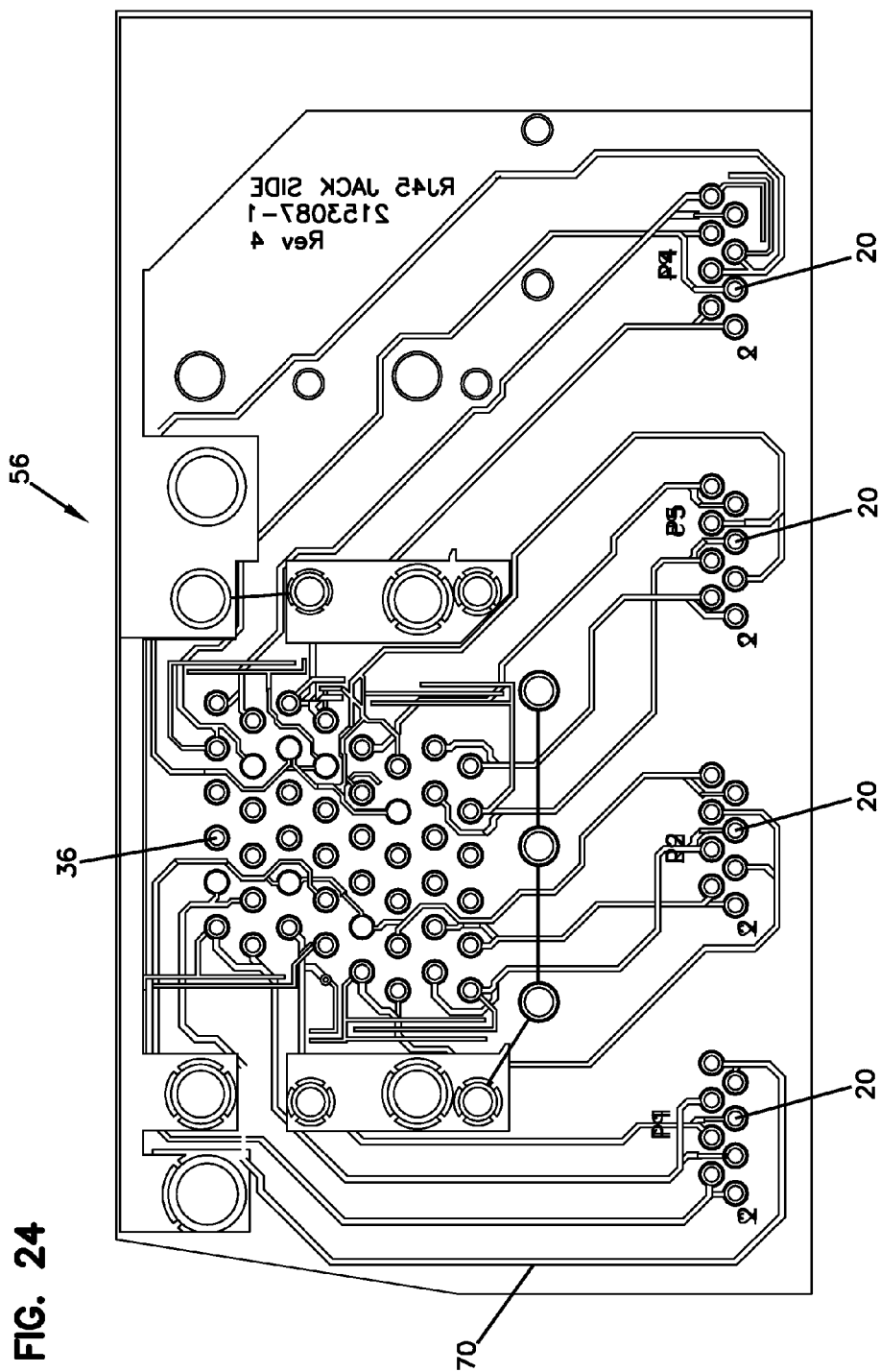


FIG. 22





1

TELECOMMUNICATIONS CASSETTE**CROSS-REFERENCE TO RELATED APPLICATION**

The present patent application claims the benefit of U.S. Provisional Patent Application Ser. No. 61/663,950, filed Jun. 25, 2012, which application is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

Telecommunications equipment is known for connecting telecommunications cables to each other and to other equipment. In the case of twisted pair copper telecommunications cables, various connector formats are known, including RJ45, and MRJ21. An RJ45 connector usually terminates a four-pair copper cable. An MRJ21 connector usually terminates a 24-pair copper cable.

Cassettes are sometimes used to group connectors together for cable management or for other reasons. The cassettes are mountable in telecommunications equipment such as patch panels. Sometimes the cassettes snap into place. Various concerns exist in data centers and other telecommunications equipment rooms or areas including space constraints, ease of use, and cost. There is a need for continued improvement in patch panel design, cassette design, and cable connectivity.

SUMMARY OF THE INVENTION

One aspect of the present invention relates to a telecommunications cassette including a body construction having a front and an opposite rear. The front includes RJ45 jacks. The rear includes MRJ21 connectors. The cassette is used to connect RJ45 four pair patch cables to MRJ21 multi-pair cables. In one embodiment, two rows of four RJ45 jacks are provided on the front surface, and two MRJ21 connectors are provided on the rear surface. Two circuit boards are provided in the interior of the cassette. One circuit board connects four of the RJ45 jacks to one of the MRJ21 connectors, and a second circuit board is provided connecting a second four of the RJ45 jacks to the second MRJ21 connector. In one embodiment, an upper row of RJ45 jacks is connected to one MRJ21 connector, and a lower row of RJ45 jacks is connected to the second MRJ21 connector. The MRJ21 connectors have the same orientation, whereas the RJ45 jacks have a flipped orientation between the top row and the bottom row. In one implementation, the top row of RJ45 jacks is offset or shifted from the bottom row of RJ45 jacks.

In one implementation, one of the MRJ21 connectors is positioned in a notched region of the circuit board connected to the other MRJ21 connector.

In one implementation, both of the MRJ21 connectors are mounted on the same facing side of the respective circuit board, and the two rows of RJ45 jacks are mounted on outward facing sides of the circuit boards.

In one implementation, circuit tracing and management is included with the cassette.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top, front perspective view of a patch panel including two telecommunications cassettes in accordance with the present invention;

2

FIG. 2 is a bottom, rear perspective view of the patch panel of FIG. 1;

FIG. 3 is a top, front perspective view of one of the telecommunications cassettes including two mated RJ45 plugs for a cable tracing and management system;

FIG. 4 is a side view of the cassette of FIG. 3;

FIG. 5 is a side view of one of the RJ45 plugs of FIG. 3;

FIG. 6 is a front view of the RJ45 plug of FIG. 5;

FIG. 7 is a front view of the cassette of FIG. 3;

FIG. 8 is a top, front perspective view of the cassette shown in FIG. 3;

FIG. 9 is a front view of the cassette shown in FIG. 8;

FIG. 10 is a side view of the cassette shown in FIG. 8;

FIG. 11 is a rear view of the cassette shown in FIG. 8;

FIG. 12 is a top, front perspective view of an alternative cassette;

FIG. 13 is a front view of the cassette of FIG. 12;

FIG. 14 is a rear view of the cassette of FIG. 13;

FIG. 15 is a side view of the cassette of FIG. 12;

FIG. 16 is a front view of the front RJ45 jacks, and the internal circuitry of the cassettes shown in FIGS. 1-15;

FIG. 17 is a rear view of the components shown in FIG. 16 including the MRJ21 connectors;

FIG. 18 is a top view of the components shown in FIG. 16;

FIG. 19 is a bottom view of the components shown in FIG. 16;

FIG. 20 is a side view of the components shown in FIG. 16;

FIG. 21 is a top, front perspective view of the components shown in FIG. 16;

FIG. 22 is a bottom, rear perspective view of the components shown in FIG. 16;

FIG. 23 is one implementation of one of the printed circuit boards of the cassette;

FIG. 24 is one implementation of another one of the printed circuit boards of the cassette.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. 1 and 2, a patch panel 10 is shown including a front 12 having two telecommunications cassette 14 mounted to front 12. Four cassettes 14 can be used in patch panel 10. In the implementation shown, panel 10 has an angled front 12. Panel 10 also includes a rear cable manager 16.

Referring now to FIGS. 3 through 7, telecommunications cassette 14 is shown with two connectors or plugs 18 mounted to RJ45 jacks 20. Plugs 18 include main contacts 22, such as eight, and an additional contact 24 for use in patch-cord tracing and management. Additional contact 24 is received by conductive pad 26 of PCB 28 adjacent to each jack 20. Plugs 18 each terminate four pair (twisted pairs) copper cables 19. Plugs 18 electrically connect to contacts in each jack 20.

Referring now to FIGS. 8 through 11, telecommunications cassette 14 is shown in greater detail. Cassette 14 includes a body 30, a front 32, and a rear 34. Jacks 20 are mounted on front 32. MRJ21 connectors 36 are mounted to rear 34. As shown, there are eight RJ45 jacks 20, mounted in two rows 38. The orientation of the jacks 20 is reversed between the two rows 38. Also, as shown the MRJ21 connectors 36 are oriented in the same direction but staggered slightly vertically. Note the non-symmetrical shape of the connectors 36 as shown in FIG. 11.

On rear 34 is a further connector 42 as part of the cable management and tracing functionality of cassette 14. As will

3

be described below, circuitry contained within cassette **14** connects RJ45 jacks **20** to MRJ21 connectors **36**. The connection between the additional contact **24** of plugs **18** and connector **42** is known technology for cable management and tracing.

Cassette **14** includes angled sides **35** which help to allow for the angled mounting as shown in FIGS. **1** and **2**.

Cassette **14** has a height **62** less than 44.25 mm. Preferably, the height is less than 40.00 mm. More preferably, the height **62** is less than 37 mm. More preferably, the height is less than 35 mm. In one implementation, the height is 34.82 mm.

Referring now to FIGS. **12** through **15**, an alternative telecommunications cassette **114** is shown. Cassette **114** has a similar construction to cassette **14**. One difference is that cassette **114** lacks the cable management and tracing function. A front window **46** is provided for cassette management upgrade. A PCB **28** would be added to add the cable management and tracing features. Cassette **114** includes the front two rows of RJ45 jacks **20** and the two rear MRJ21 connectors **36**, slightly offset from each other as in cassette **14**.

As can be seen in FIGS. **8** through **15**, the two rows **38** of RJ45 jacks **20** are reversed relative to each other in jack orientation. Also, the rows **38** are offset from one another. Referring now to FIGS. **16** through **22**, the cassettes **14**, **114** with the RJ45 jacks **20** and the MRJ21 connectors **36** are shown including the internal connectivity structure linking the various jacks and connectors. As shown, two printed circuit boards (PCBs) **50** are located within the interior of body **30**. A first PCB is labeled **52**, and a second PCB is labeled **56**. A first row **39** of RJ45 jacks **20** is connected to first PCB **52** and a second row **40** of RJ45 jacks **20** is connected to second PCB **56**. Each jack **20** is snap-fit to each respective PCB **52**, **56** with resilient snaps **58** which project through openings **60** in PCB **52**, **56**. Jacks **20** are also electrically connected to the respective PCB **52**, **56**, such as through soldering. By offsetting the rows **39**, **40** of jacks **20**, the snaps **58** do not interfere with each other. Such a feature helps reduce the height dimension **62** of body **30** of cassettes **14**, **114**. Through circuit tracings **70** on PCBs **52**, **56** MRJ21 connectors **36** are connected to RJ45 jacks **20**.

Also, orienting one of the MRJ21 connectors **41** on the same side of the circuit board **50** as jacks **20** allows for a reduction in height **62** of body **30**. A further notch **66** allows for MRJ21 connector **37** to be mounted on the opposite side of second PCB **56** without interfering with first PCB **52**. Each connector **36** is snap-fit to each respective PCB **52**, **56** with resilient snaps **58** which project through openings **60** in PCB **52**, **56**. Connectors **36** are also electrically connected to the respective PCB **52**, **56**, such as through soldering. MRJ21 connectors **36** and the mating connectors which mate with connectors **36** are shown for example in U.S. Pat. Nos. 6,582,255; 7,901,236; and 7,901,238, the disclosures of which are hereby incorporated by reference. Even though each MRJ21 connector **36** is capable of handling **24** pairs of connections, only 16 pairs of connections are utilized as shown and described in U.S. Patent Application Ser. No. 61/579,578, filed Dec. 22, 2011, the disclosure of which is incorporated by reference.

Therefore, with the constructions described above and shown in the drawings, a reduced profile is provided with cassettes **14**, **114** due to the arrangement of the internal parts connecting the RJ45 jacks **20** to the MRJ21 connectors **36**. Such a construction of the interior circuitry also does not cause excessive increases in a depth **64** of cassettes **14**, **114**.

4

In the illustrated embodiments, cassettes **14**, **114** achieve 10 GbE electrical performance. See the tracings **70** on the PCBs **52**, **56** of FIGS. **23** and **24**.

Cassettes **14**, **114** link four-pair cables **19** with plugs **18** at front jacks **20** to multi-air cables (e.g. 24-pair) connected with connectors to MRJ21 connectors **36**. One preferred usage is in patch panel **10**. One preferred circuit arrangement is eight-port cassettes with two multi-pair rear connectors.

10 patch panel

14 cassette

16 rear cable manager

18 plugs

19 copper cables

20 jacks

22 main contacts

24 additional contact

26 conductive pad

28 pcb

30 body

35 angled sides

36 connector

38 two rows

39 first row

40 second row

42 connector

46 front window

50 circuit boards

52 first pcb

56 second pcb

58 resilient snaps

60 openings

62 height

64 depth

66 notch

70 tracings

114 alternative telecommunications cassette

The invention claimed is:

1. A telecommunications cassette (**14**, **114**) comprising:
 - a body (**30**) having depth (**64**) defined between a front (**32**) and an opposite rear (**34**), a height (**62**) defined between a first surface and a second surface, and a width defined perpendicularly with respect to the height and the depth;
 - two rows (**39**, **40**) of RJ45 jacks (**20**) disposed on the front (**32**), wherein the two rows of RJ45 jacks comprise a first row and a second row extending in parallel to the width of the body (**30**);
 - two MRJ21 connectors (**36**) disposed on the rear (**34**), wherein the two MRJ21 connectors comprise a first MRJ21 connector and a second MRJ21 connector;
 - wherein the two rows (**39**, **40**) of RJ45 jacks (**20**) are oriented opposite to one another in parallel to the width of the body (**30**);
 - wherein the two rows (**39**, **40**) of RJ45 jacks (**20**) are offset from one another along the width of the body (**30**);
 - wherein the MRJ21 connectors (**36**) are oriented pursuant to a common direction, and have a common orientation with reference to the height (**62**) and width of the body (**30**);
 - wherein the MRJ21 connectors (**36**) are offset from one another along the height (**62**) of the body (**30**);
 - wherein two circuit boards (**52**, **56**) are provided in parallel and offset along the width within the body (**30**), wherein the two circuit boards comprise a first circuit board and a second circuit board, wherein the two circuit boards comprise a first surface with orientation

5

corresponding to the first surface of the body (30) and a second surface with orientation corresponding to the second surface of the body (30), wherein the first row of RJ45 jacks and the first MRJ21 connector are mounted to the first circuit board first surface, wherein the second row of RJ45 jacks is mounted to the second circuit board second surface and the second MRJ21 connector is mounted to the second circuit board first surface; wherein one row (39, 40) of RJ45 jacks (20) is connected to a respective one of the MRJ21 connectors (36).

2. The telecommunications cassette of claim 1, wherein there are four RJ45 jacks (20) in each row (39, 40).

3. The telecommunications cassette of claim 1, wherein one of the circuit boards (52, 56) includes a notch for receiving one of the MRJ21 connectors (36).

4. The telecommunications cassette of claim 1, wherein four cassettes (14, 114) are mounted in a row in a patch panel (10).

5. The telecommunications cassette of claim 4, wherein the four cassettes (14, 114) are mounted in an angled row in the patch panel (10).

6. The telecommunications cassette of claim 1, wherein the first and second MRJ21 connectors are oriented in the same direction.

7. The telecommunications cassette of claim 1, wherein the first and second rows of RJ45 jacks are oriented along different directions from one another.

8. A telecommunications connector system comprising:
a first assembly comprising a first circuit board with an first surface and a second surface, a first row of RJ45 jacks and a first MRJ21 connector, wherein the first

6

assembly comprises a height, a depth and a width along which the first row of RJ45 jacks extend;

a second assembly comprising a second circuit board with a first surface and a second surface, a second row of RJ45 jacks and a second MRJ21 connector, wherein the second assembly comprises a height, a depth and a width along which the second row of RJ45 jacks extend, wherein the first circuit board and the second circuit board are arranged in parallel and offset with respect to each other, wherein the first row of RJ45 jacks and the second row of RJ45 jacks are offset from each other in parallel to the width;

wherein the first circuit board first surface and the second circuit board first surface are oriented in a common direction, and the first circuit board second surface and the second circuit board second surface are oriented in a common direction; and

wherein the first row of RJ45 jacks is oriented in reverse with respect to the second row of RJ45 jacks, wherein the first row of RJ45 jacks are mounted to the first circuit board first surface and the second row of RJ45 jacks are mounted to the second circuit board second surface;

wherein the first MRJ21 connector and the second MRJ21 connector have a common orientation and are secured to the common first or second surfaces of the first and second circuit boards respectively.

9. The telecommunications connector system of claim 8, further comprising a housing, wherein the first assembly and the second assembly are positioned in the housing.

* * * * *